Airship Technology… A Historical Perspective and the Way Ahead

2nd Airships to the Arctic Symposium

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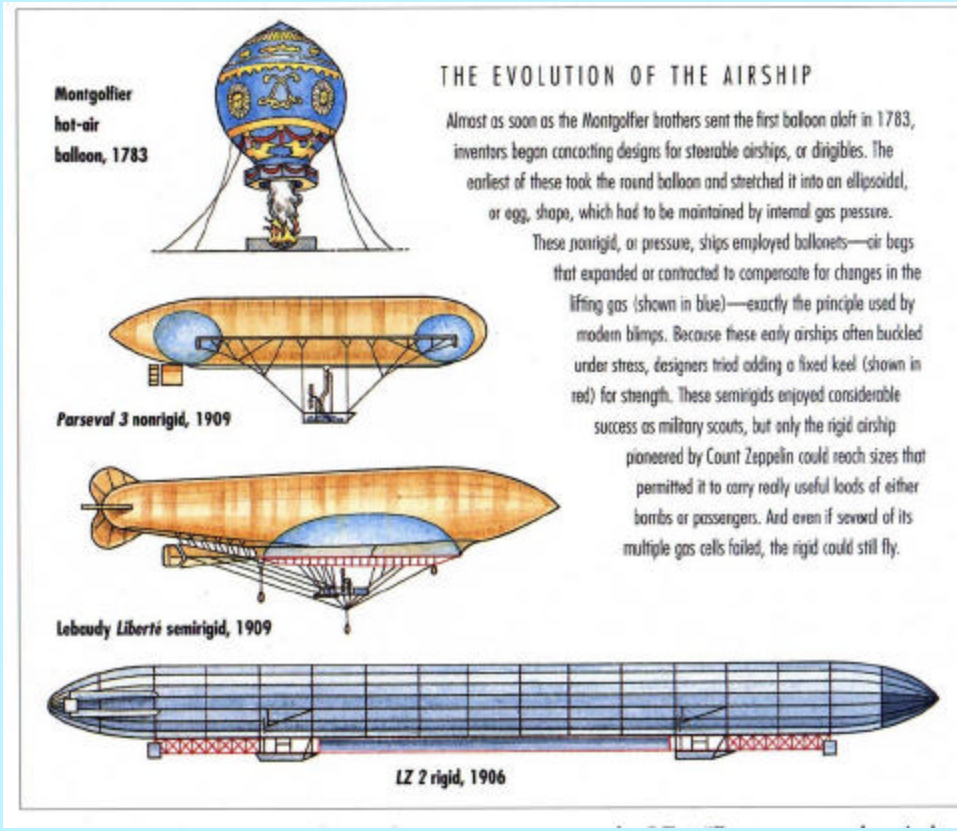
Since the Beginning…

- Airships have always attempted to integrate the benefits of numerous burgeoning technologies
  - Buoyancy (e.g. Balloons)
  - Self propulsion (e.g. Trains, Horseless Carriages, Ships, Aircraft)
  - Steering (e.g. Ships, Aircraft, Cars/Trucks)

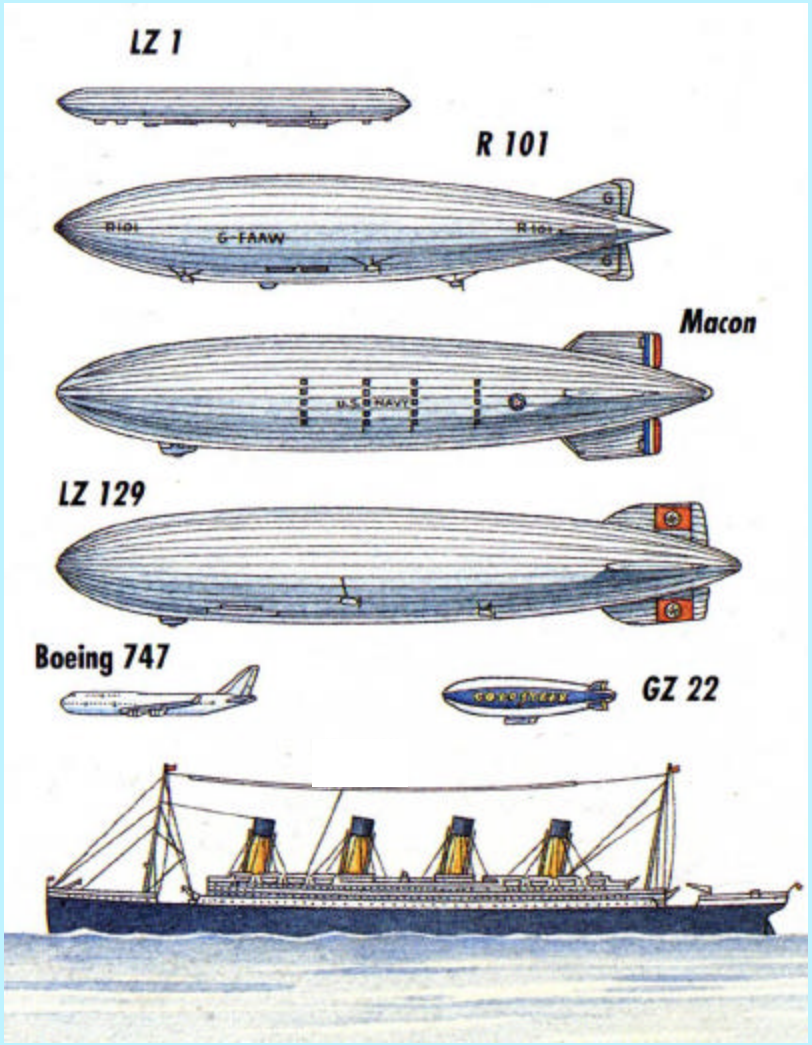
  To achieve a measure of independence from weather, geography, infrastructure…



Picture from Archbold, Rick, “Hindenburg, An Illustrated History”

As they Evolved…

- They proved that the combinations of technologies they employed were feasible:
  - technically, at least…
  - in ways that other platforms could not easily, (if ever) match…
    - Range
    - Freedom of maneuver
    - Independence from ground infrastructure



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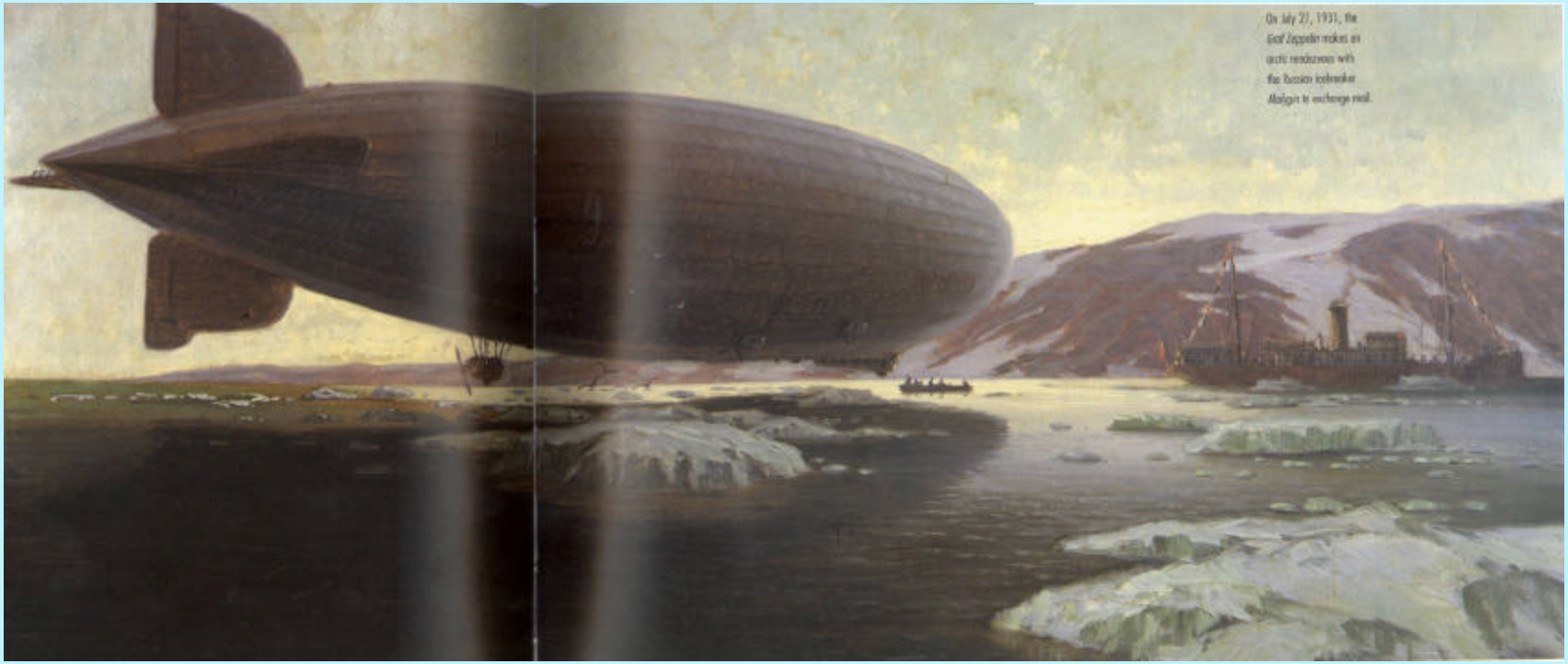
Milestones along the way…

- Arctic Operations



Picture from Archbold, Rick, “Hindenburg, An Illustrated History”

Milestones along the way…

- Picking Up Payloads…

The Cycle-Crane in the former navy blimp hangar at Tillamook, Oregon, where she was built, and (above) on a brief test flight after her tail was modified to incorporate an outer ring.

Picture from Archbold, Rick, "Hindenburg, An Illustrated History"

Milestones along the way…

- Captivating the Public Interest…

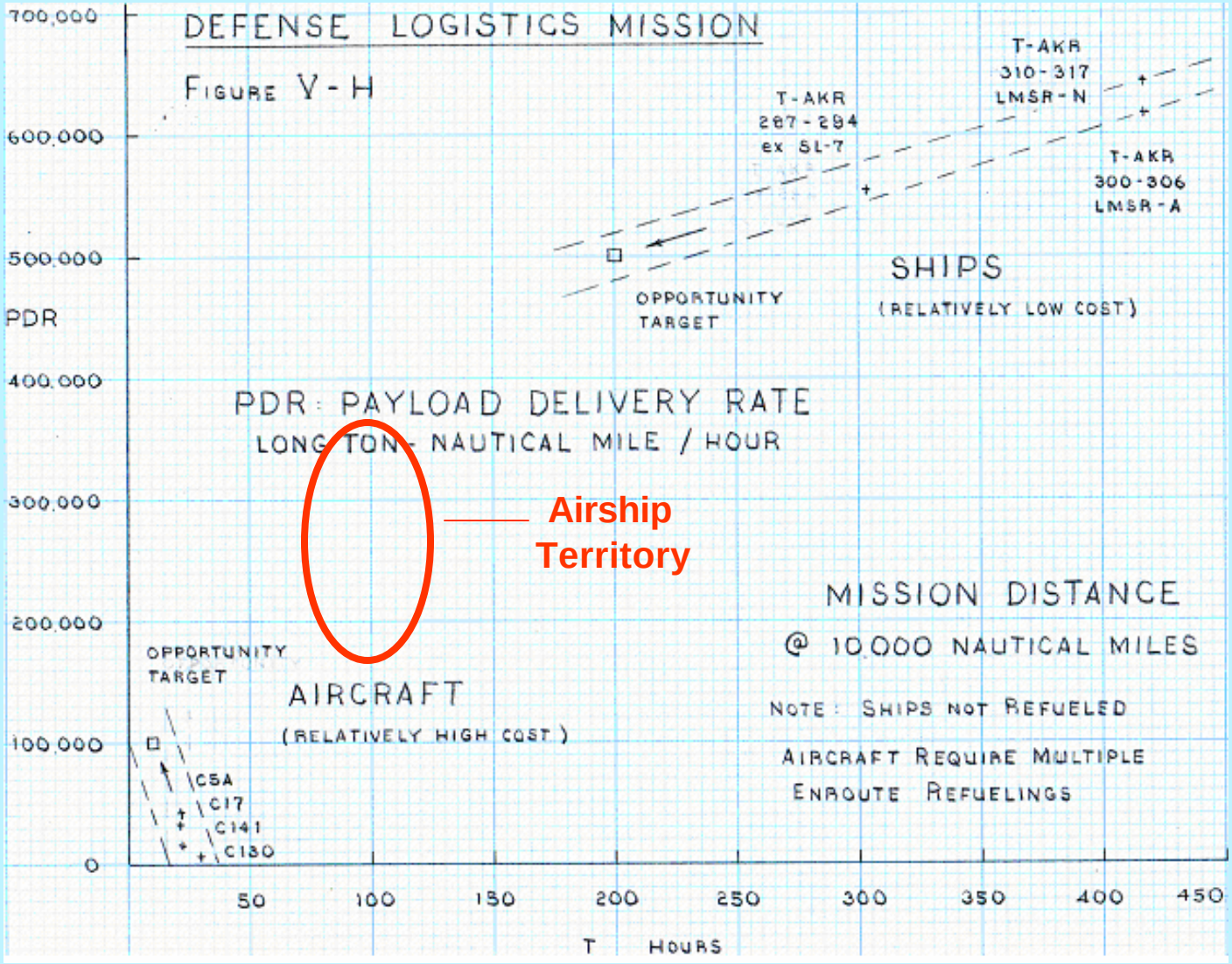
Pictures from Archbold, Rick, “Hindenburg, An Illustrated History”

So… What does this bode for the future?

- Since it has all been done before, then all we have to do is put all the available technologies together, and it will work…
  - In other words: If we build it, they will come.

- **WRONG!** With this approach, we might well build it, but…
  - It probably will not be what they need
  - It likely will cost too much to build, or operate, or both
  - It may very well prove less efficient than what we already have…

What we're really Talking About…



What we're really Talking About…

(1) Unsatisfied Requirements...

(2) Concepts that align with the Requirements but not the Technologies...

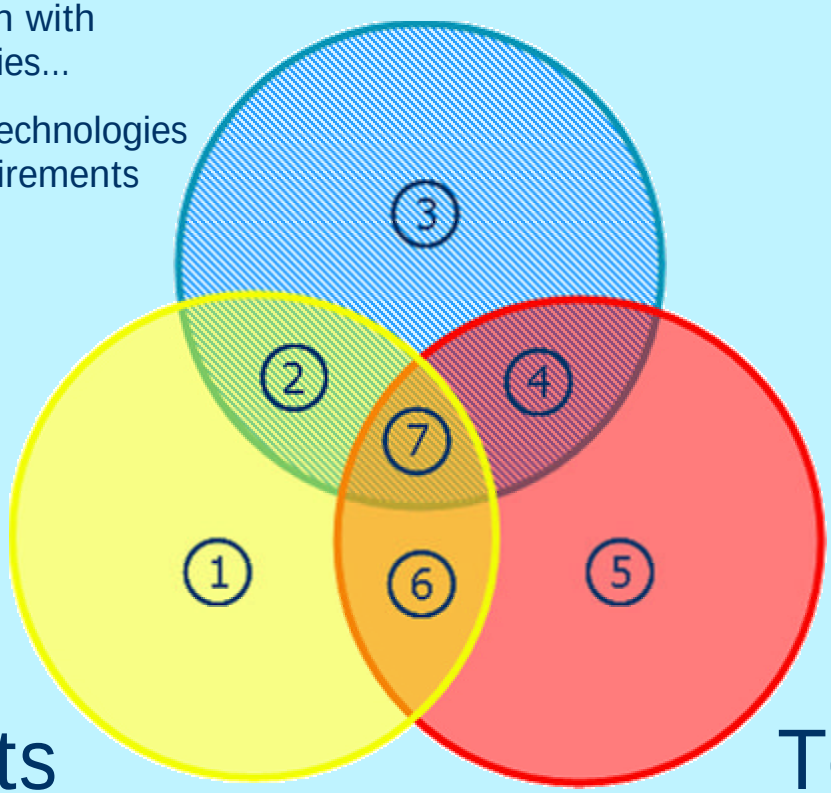
(3) Concepts that don't align with Requirements or Technologies...

(4) Concepts that Employ Technologies but don't address real Requirements

(5) Technologies for Technology's Sake: Science Projects...

(6) Technologies that satisfy some Reqts, but are incompatible with Concepts

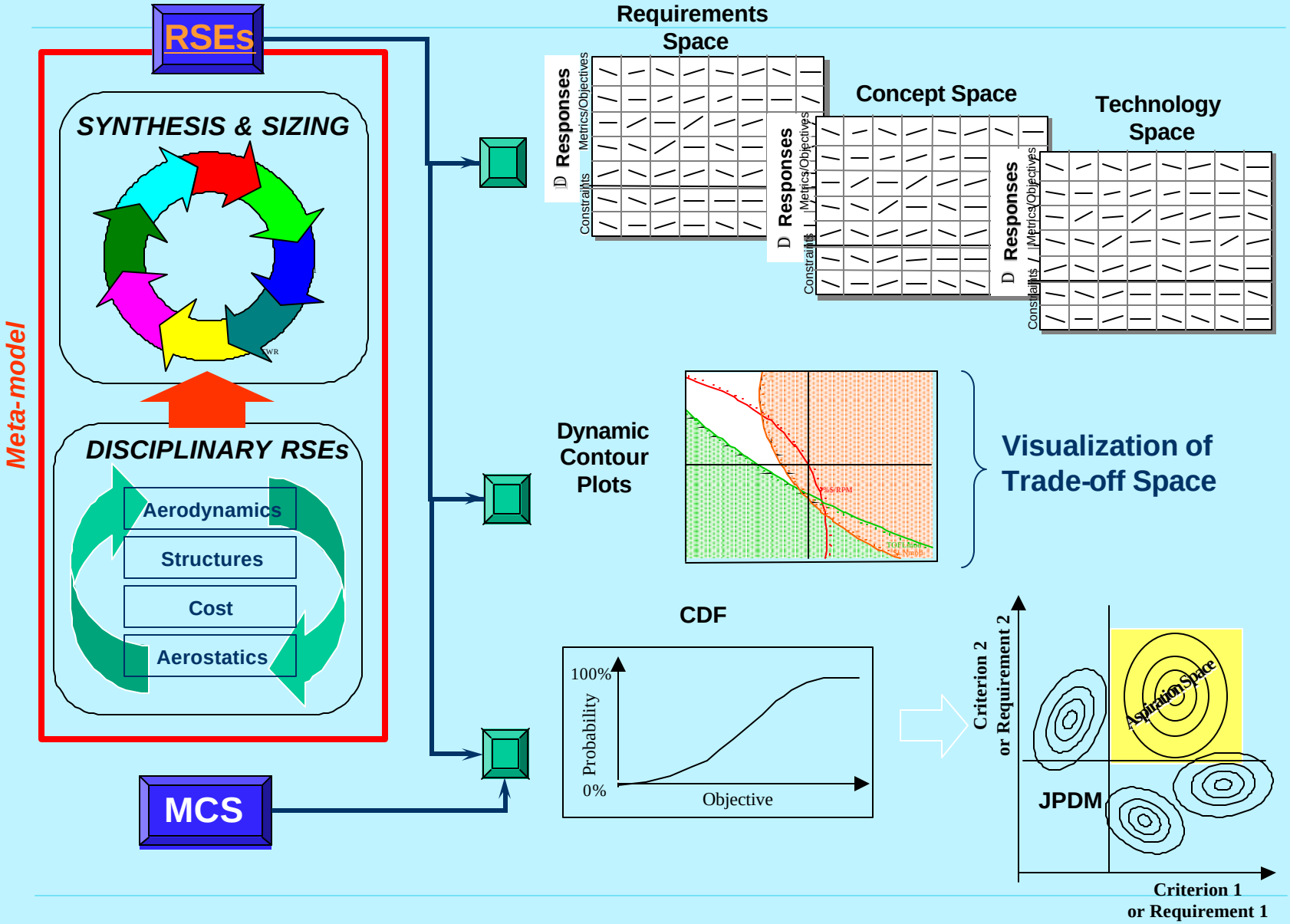
(7) "Sweet Spot"... Functional Utility



So… How do we get to the “Sweet Spot”?

Unified Trade-off Environment (UTE)

- Decision-making environment based on Response Surface Methodology (RSM) and Design of Experiments (DoE)
- Response Surface Equations (RSE) capture impact of changes in mission requirements, vehicle attributes and technologies on system level parameters
- RSEs provide an efficient analytical engine for probabilistic techniques which capture:
    - the impact of technology readiness/maturity
    - mission requirement uncertainty
- RSEs allow real time visualization of environment to facilitate decision making process


RSEs
Meta-model
SYNTHESIS & SIZING
DISCIPLINARY RSEs
Aerodynamics
Structures
Cost
Aerostatics
MCS
Requirements Space
Concept Space
Technology Space
D Responses
Metrics/Objectives
Constraints
Dynamic Contour Plots
Visualization of Trade-off Space
CDF
100%
Probability
0%
Objective
Criterion 2 or Requirement 2
Aspiration Space
JPDM
Criterion 1 or Requirement 1

In Closing…

- We need a measured, logical, focused approach to consider each business case, in the context of:
  - Requirements
  - Concepts
  - Technologies
- We have not yet said anything about whether or not to use airships, which kind of airship to use, how big an airship, or which technologies to incorporate…
  - UTE is one means to figure these things out
- Consideration of the real Requirements to address underpins the entire effort, and hence this is where we must **START**.